



# **DIESEL PARTICULATE MATTER EXPOSURE OF UNDERGROUND METAL AND NONMETAL MINERS**



# **DPM SEMINAR & WORKSHOP**

- ❖ **Welcome, Seminar Overview & Objectives**
- ❖ **Health Effects Of DPM Exposure**
- ❖ **Background**
- ❖ **Summary of Rule Provisions**
- ❖ **Provision-by-Provision Discussion**
- ❖ **Summary, Conclusions, Questions**
- ❖ **DPM Sampling Workshop (Afternoon)**
  - **DPM Controls**
  - **Sampling Equipment & Procedures**
  - **Sample Analysis and Interpretation**

# **SEMINAR OBJECTIVES**

## **Objectives:**

- 1. Provide information about DPM standard to enable compliance with provisions now in effect**
- 2. Provide general background information and compliance assistance on DPM controls and DPM sampling**
- 3. Answer questions**

# Health Effects Of DPM Exposure

## ❖ Acute Effects

- Respiratory Irritation (Including Allergic Responses)

## ❖ Chronic Effects

- Premature Death From Cardiovascular, Cardiopulmonary, and Respiratory Causes
- Lung Cancer

# Background

- ❖ Rule published in FR on January 19, 2001
- ❖ Provisions effective as of July 20, 2002:
  - §57.5060(a) Interim concentration limit
  - §57.5061 Compliance determinations
  - §57.5065(a) and (b) Fueling
  - §57.5066 Maintenance
  - §57.5067 Engines
  - §57.5070 Miner training
  - §57.5071 Environmental monitoring
  - §57.5075 Diesel particulate records

# Background

## ❖ Provisions not effective at this time:

### Stayed provisions

- §57.5060 (d) working in concentrations of DPM that exceed interim limit
- §57.5060 (e) and (f) restricting or prohibiting PPE and administrative controls as means of complying with interim limit
- §57.5062 DPM control plans

### Provisions scheduled to become effective after January 19, 2006

- §57.5060(b) final concentration limit
- §57.5060(c) special extensions

# Background

## ❖ Other terms of July 15, 2002 partial settlement agreement:

- MSHA will provide compliance assistance (DPM baseline sampling and information on DPM controls) until July 19, 2003
- Violations of interim limit will be cited beginning July 20, 2003
- Feasible engr or admin controls and work practice controls required; may be supplemented by PPE
- Job rotation not allowed for compliance

# Background

- Personal sampling only for compliance determinations (no area or occupational sampling)
- Mine operators must develop and implement written compliance strategy
- MSHA may take “appropriate enforcement action” against mine operators who do not take good faith steps toward developing and implementing written compliance strategy



# Background

- Two step process for determining total carbon concentration
- MSHA will initiate proposed rulemaking to change certain provisions of the rule
  - ◆ Advance Notice of Proposed Rulemaking (ANPRM) issued Sept. 25, 2002
  - ◆ ANPRM can be viewed at:  
<http://www.msha.gov/REGS/FEDREG/ANPRM/2002/02-24370.HTM>
  - ◆ Comment period on ANPRM ends  
Nov. 25, 2002

# **Final Rule Published January 19, 2001**

- § 57.5060 Limit on the concentration of diesel particulate matter**
- § 57.5061 Compliance determinations**
- § 57.5062 Diesel particulate matter control plan**
- § 57.5065 Fueling practices**
- § 57.5066 Maintenance standards**
- § 57.5067 Engines**
- § 57.5070 Miner training**
- § 57.5071 Environmental monitoring**
- § 57.5075 Diesel particulate records**

# **Provisions effective July 20, 2002**

- § 57.5060 Limit on the concentration of diesel particulate matter (interim limit only)**
- § 57.5061 Compliance determinations**
- § 57.5062 Diesel particulate matter control plan**
- § 57.5065 Fueling practices**
- § 57.5066 Maintenance standards**
- § 57.5067 Engines**
- § 57.5070 Miner training**
- § 57.5071 Environmental monitoring**
- § 57.5075 Diesel particulate records**

# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter**
- § 57.5061 Compliance determinations
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
- § 57.5066 Maintenance standards
- § 57.5067 Engines
- § 57.5070 Miner training
- § 57.5071 Environmental monitoring
- § 57.5075 Diesel particulate records

## **§57.5060(a) Interim DPM Limit**

- ❖ Mine operator must limit exposure to DPM by restricting average 8-hr equivalent full-shift airborne concentration of total carbon to:

$$400_{TC} \mu\text{g}/\text{m}^3$$

- ❖ 1,000 microgram ( $\mu\text{g}$ ) = 1 milligram (mg)

# **§57.5060(a) Interim DPM Limit**

## **❖ Why limit total carbon ?**

- Can't sample/analyze DPM**
- DPM consistently 80%-85% total carbon**
- sampling/analysis for total carbon meets NIOSH accuracy criteria at low concentration**

## **❖ §57.5060(a) has 2 components:**

- Limit established at  $400_{TC} \mu\text{g}/\text{m}^3$**
- Mine operators must restrict exposures**

## **§57.5060(a) Interim DPM Limit**

- ❖ **Restricting exposures requires mine operators to use “hierarchy of controls”**
  - **Feasible engineering and administrative controls, including work practice controls, must be implemented first (job rotation not allowed as means of compliance);**
  - **If exposures continue to exceed established limit . . . ;**
  - **. . . use of personal protective equipment (respirators) is required**

## **§57.5060(a) Interim DPM Limit**

### **❖ Standard is “Performance Oriented”**

- Mine operator chooses controls

### **❖ Engineering controls eliminate hazard through substitution, isolation, enclosure, and ventilation. Examples:**

- DPM exhaust filters
- Low emission engines
- Environmental cabs (filtered breathing air)
- Ventilation upgrades (main or auxiliary)
- Alternate fuels, fuel additives
- Remotely controlled equipment



## **§57.5060(a) Interim DPM Limit**

- ❖ **Administrative, including work practice controls, change the way work tasks are performed to reduce or eliminate hazard**
  - **Job rotation (an administrative control) as a means of compliance expressly prohibited**
  - Limits on unnecessary idling
  - Limits on lugging (low speed, high load)
  - Speed limits, one-way travel
  - Limits on equipment (or hp) in area or split
  - Areas designated “off limits” for personnel or for diesel equipment

## **§57.5060(a) Interim DPM Limit**

- ❖ If exposure exceeds interim limit despite all feasible engr and administrative controls, PPE required as means of compliance**
- ❖ PPE also required while engr and admin controls being established**
- ❖ When PPE required, respiratory protection program per ANSI Z88.2 also required (written SOP's, fit testing, storage/cleaning training, inspection, surveillance)**

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls For DPM**

- **DPM exhaust filters**
- **Low emission engines**
- **Environmental cabs (filtered breathing air)**
- **Ventilation upgrades (main or auxiliary)**
- **Alternate fuels, fuel additives**
- **Remotely controlled equipment**

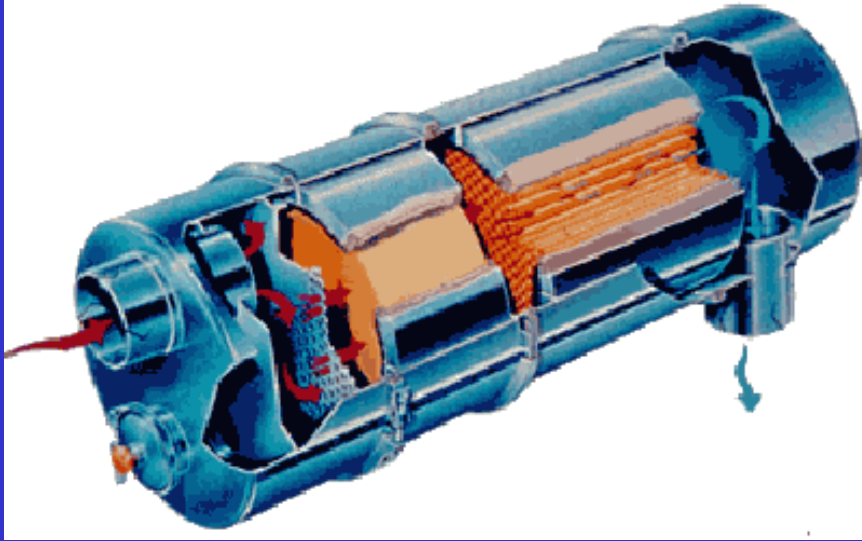
# Effectiveness of Engr Controls

- ❖ **DPM exhaust filters - 80 to 99% efficient**
  - 80% efficiency reduces 800 Fg/m<sup>3</sup> to 160 Fg/m<sup>3</sup>
  - 99% efficiency reduces 800 Fg/m<sup>3</sup> to 8 Fg/m<sup>3</sup>
- ❖ **Low emission engines - effect depends on engines - 95+% reduction possible**
  - Example: old “dirty” engine (emissions of 1.0 g/bhp-hr) replaced by new “clean” engine (emissions of 0.05 g/bhp-hr) = 95% reduction, thus, 800 Fg/m<sup>3</sup> reduced to 40 Fg/m<sup>3</sup>
- ❖ **Environmental cabs - about 50% reduction**
  - 800 Fg/m<sup>3</sup> reduced to about 400 Fg/m<sup>3</sup> in cab

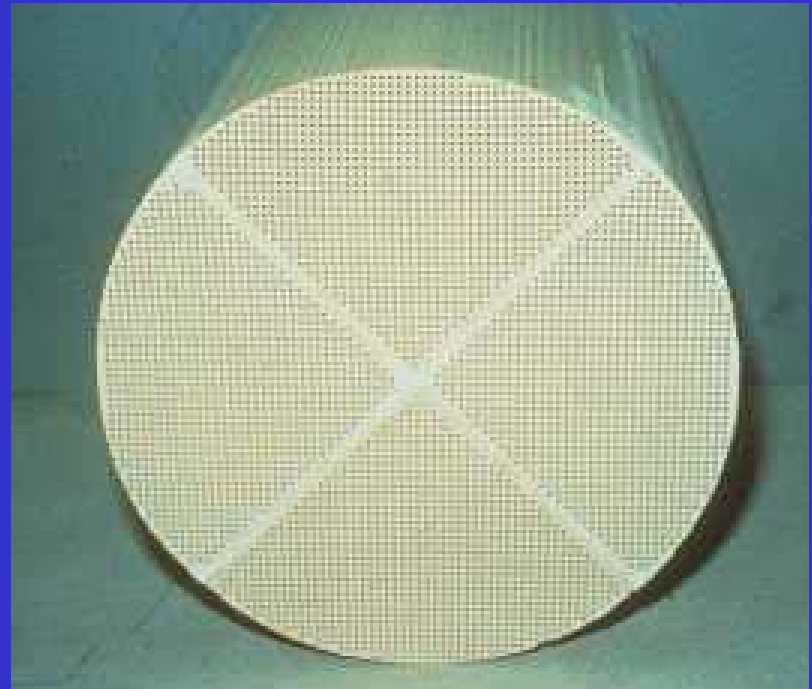
# **Effectiveness of Engr Controls**

- ❖ **Ventilation** - effect depends on nature of upgrade - improvement roughly proportional to airflow increase
  - Doubling airflow could cut DPM conc. 50%
- ❖ **Alternate fuels, fuel additives** - effect depends on fuel blend, additive, engines, etc. - results vary widely
  - 50% bio-diesel fuel reduces DPM 5-25%
  - Diesel-water emulsion reduces DPM 30%
- ❖ **Remotely controlled equipment** - effect depends on location of remote station

# §57.5060(a) Interim DPM Limit



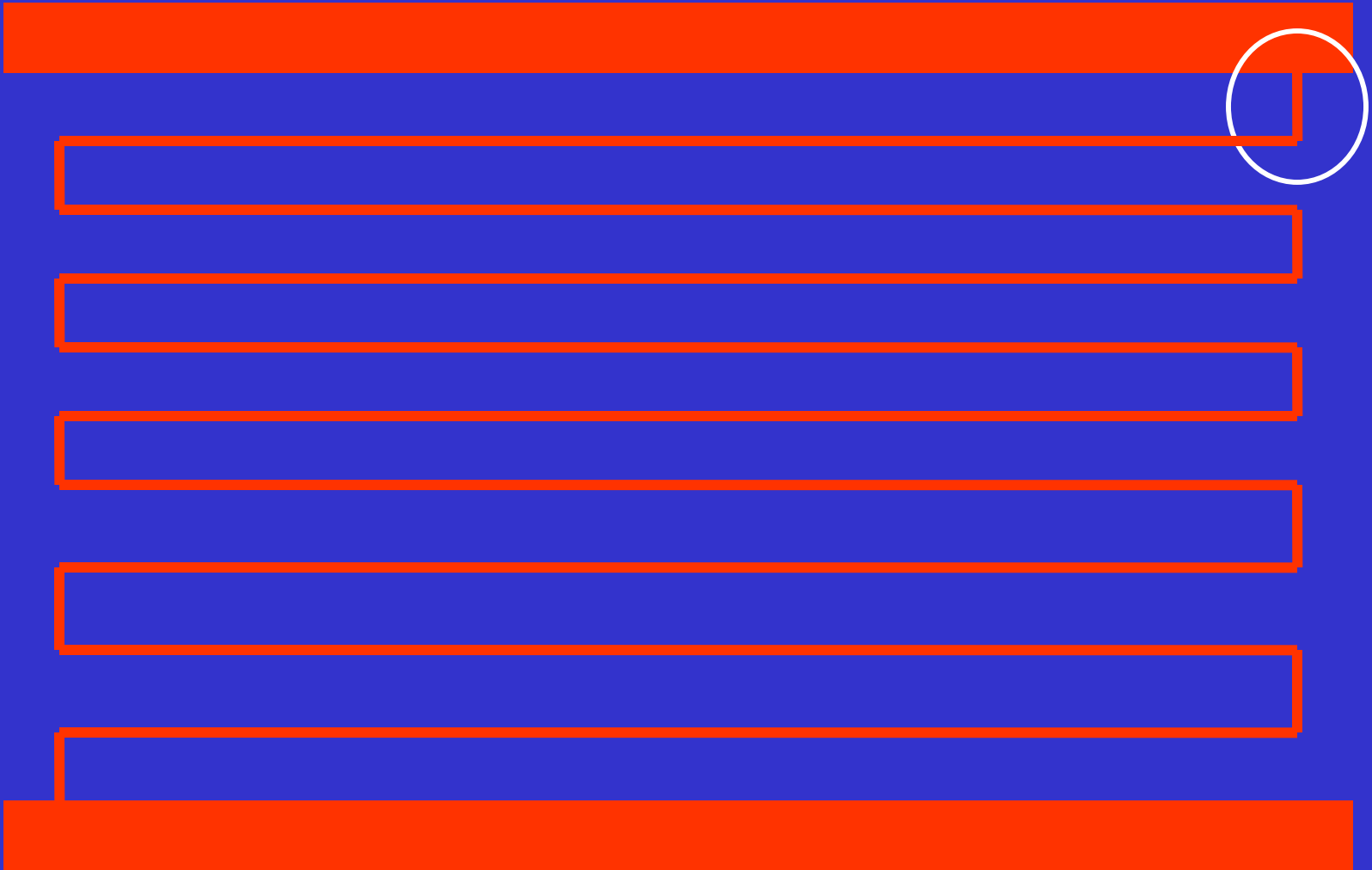
**Ceramic Wall  
Flow DPM Filter**



# Ceramic Wall Flow DPM Filter

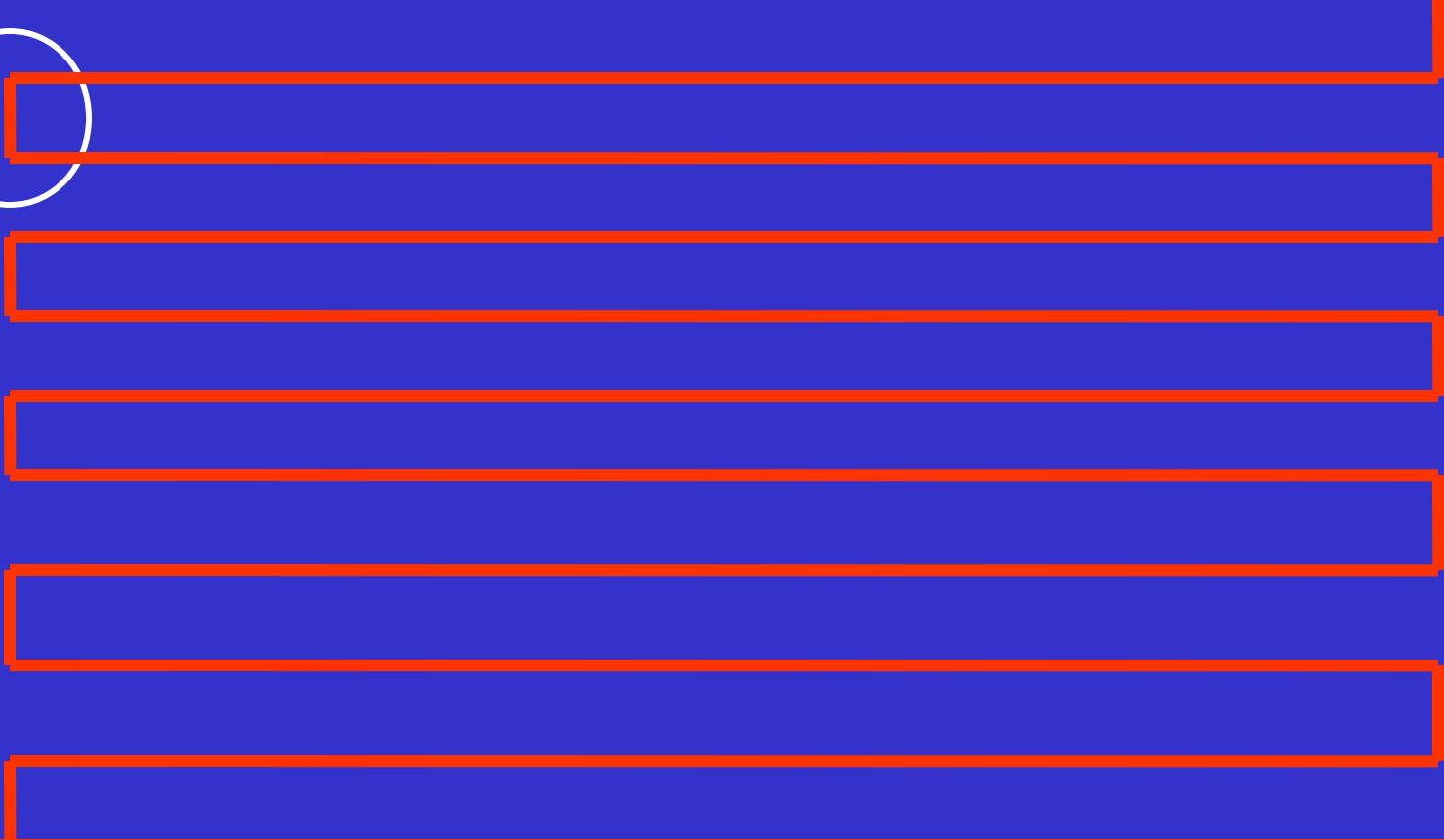
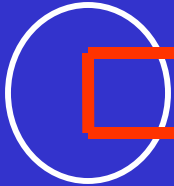


# Ceramic Wall Flow DPM Filter

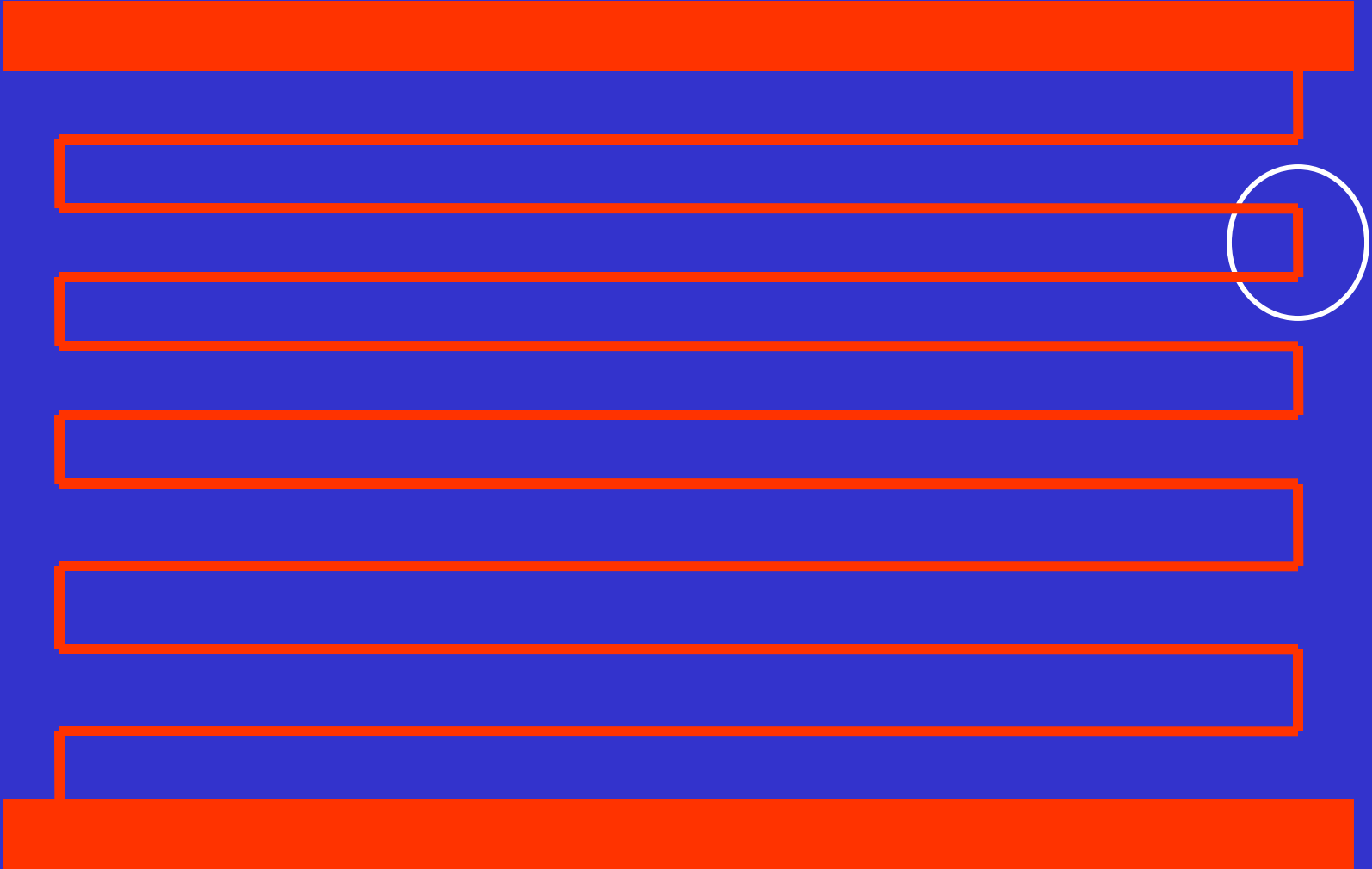




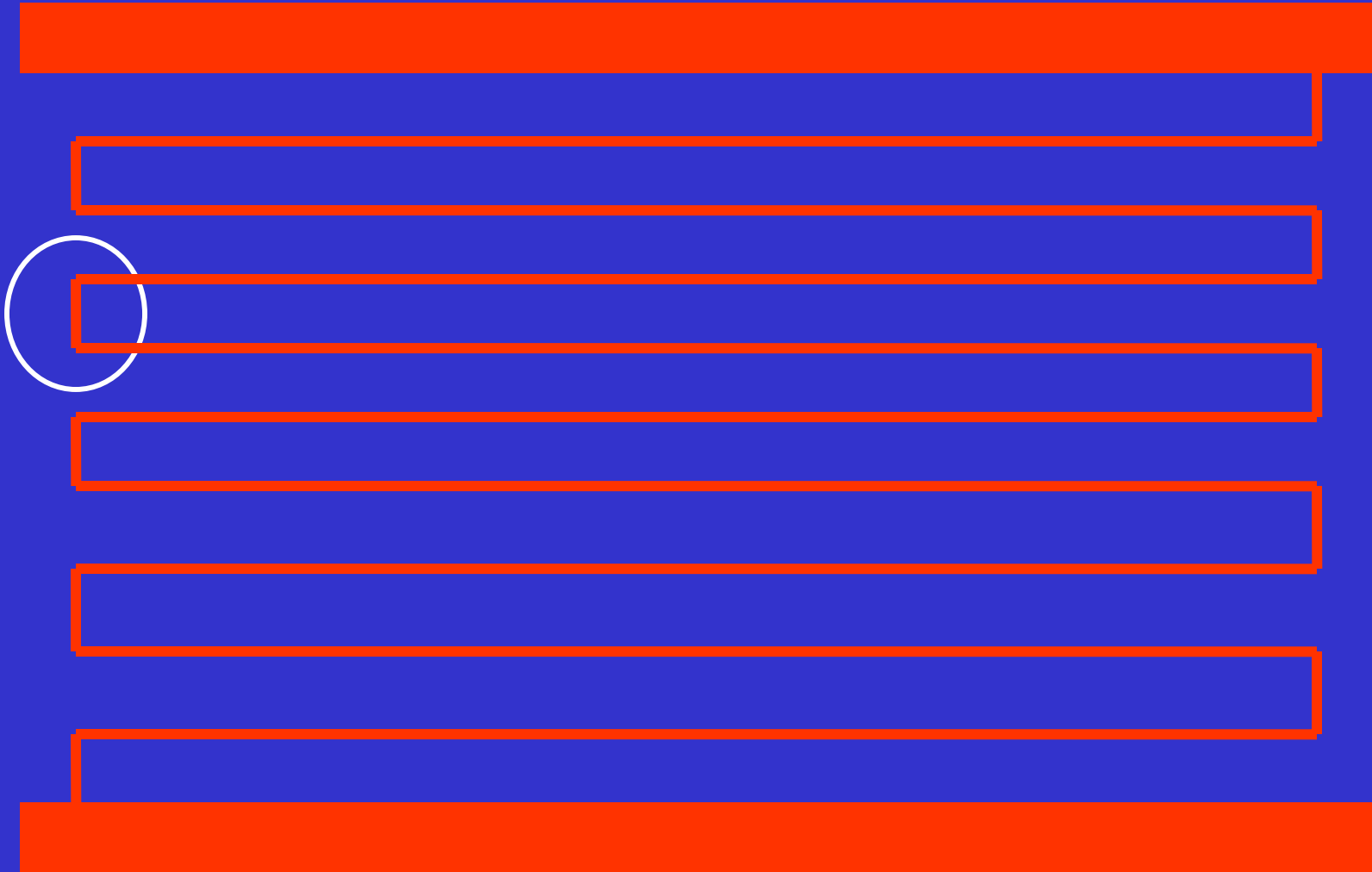
# Ceramic Wall Flow DPM Filter



# Ceramic Wall Flow DPM Filter



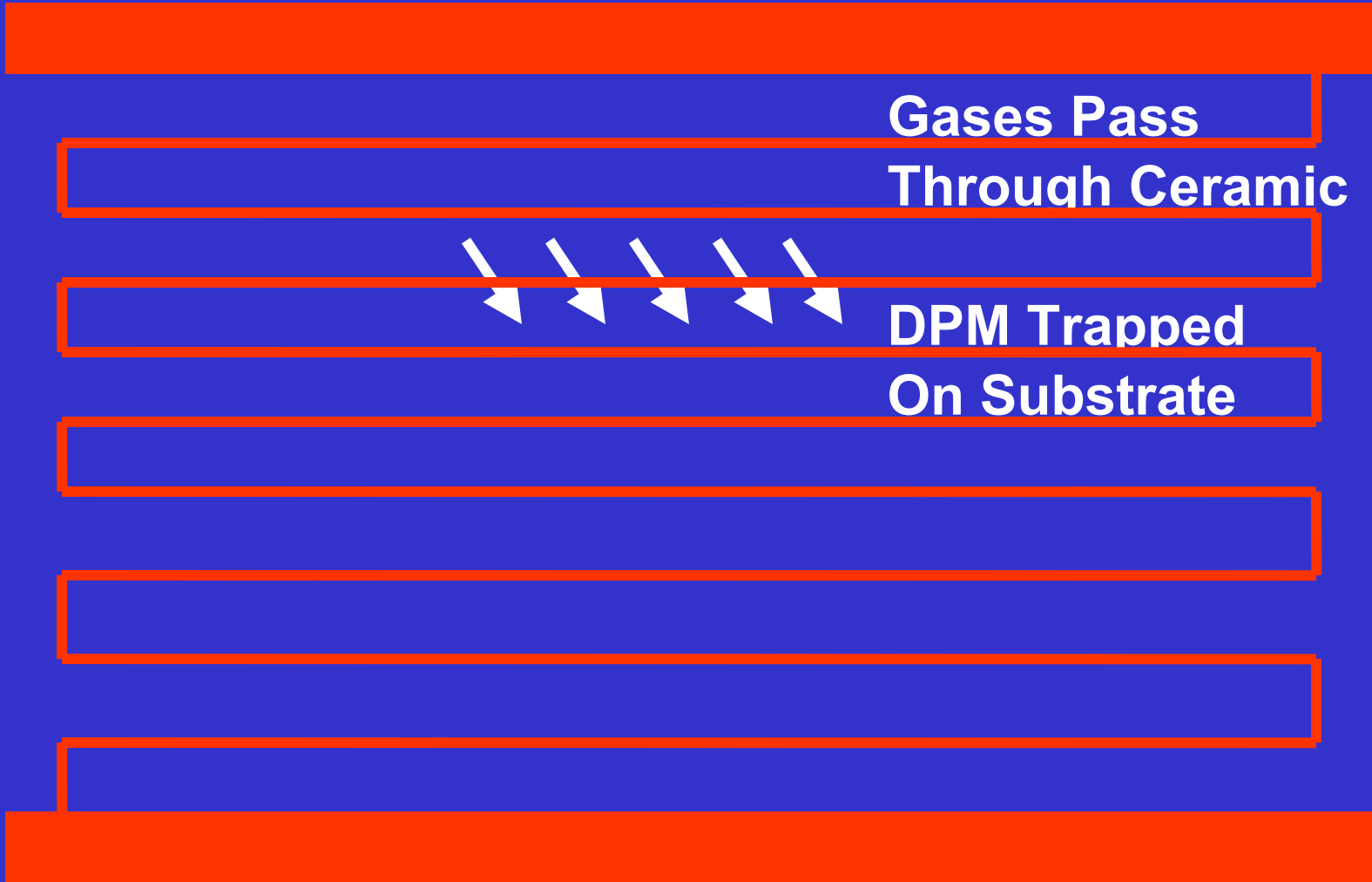
# Ceramic Wall Flow DPM Filter



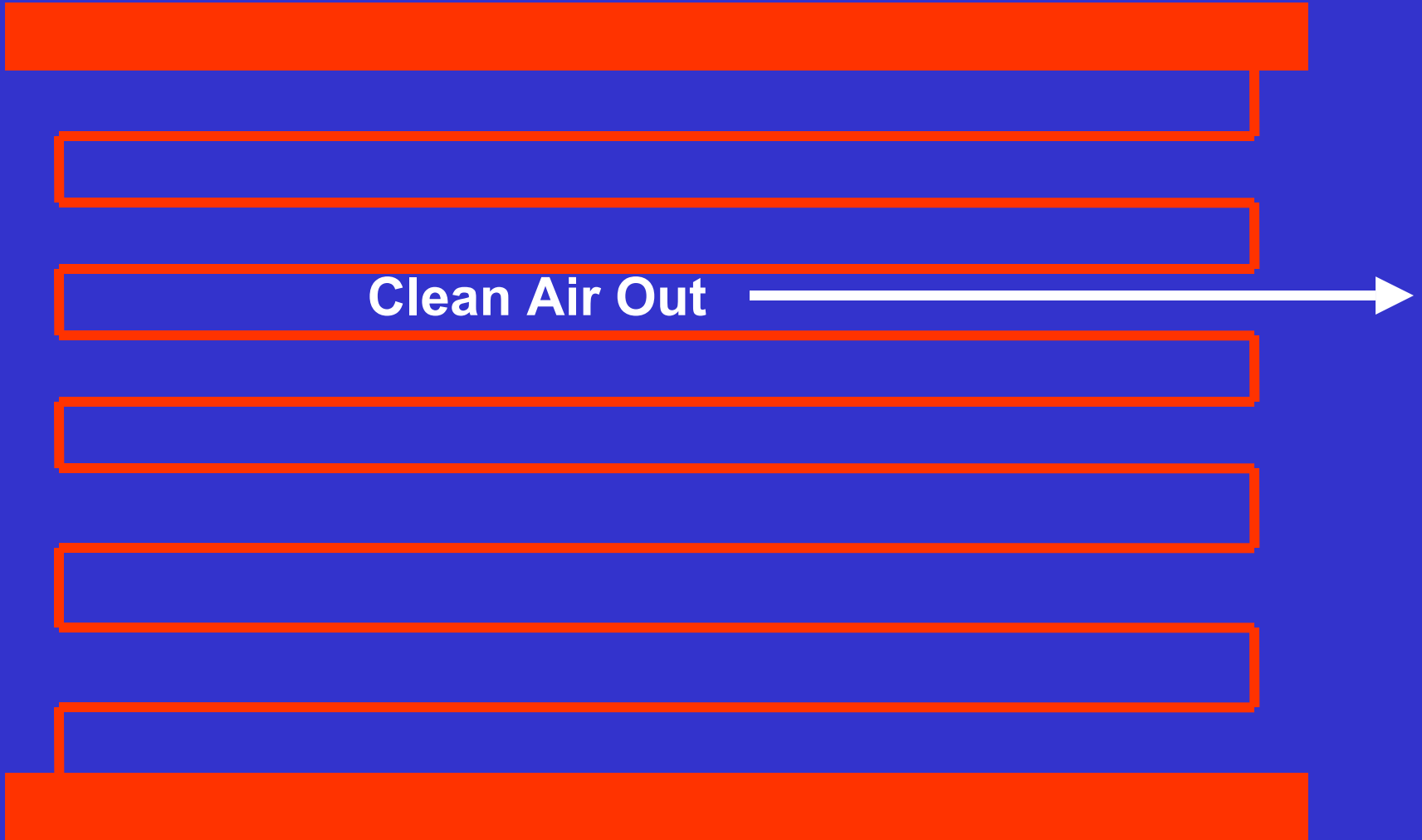
# Ceramic Wall Flow DPM Filter



# Ceramic Wall Flow DPM Filter



# Ceramic Wall Flow DPM Filter



❖ Depending on engine, use, duty cycle, ceramic wall flow DPM filter may be ***“Self Cleaning”***

***“Controlled Passive Regeneration”***

# DPM Builds Up On In-Take Side

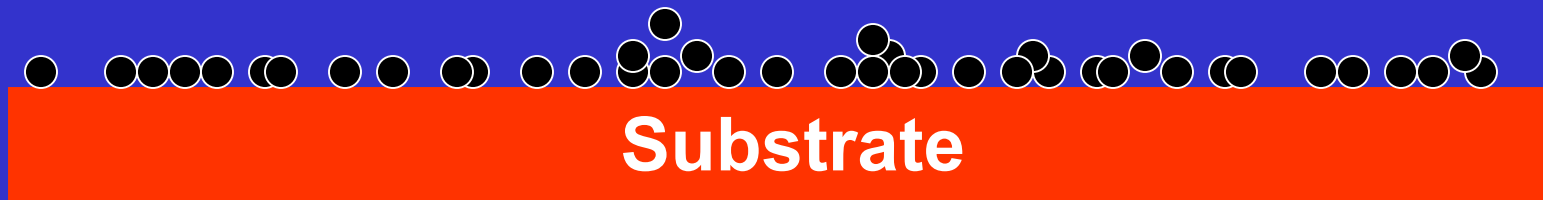




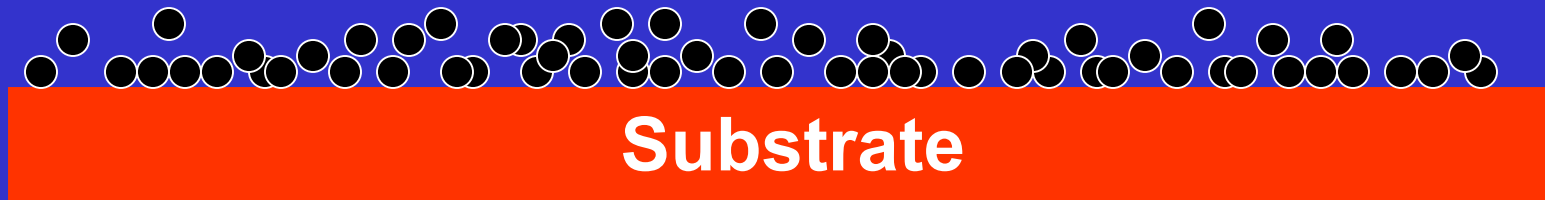
# DPM Builds Up On In-Take Side



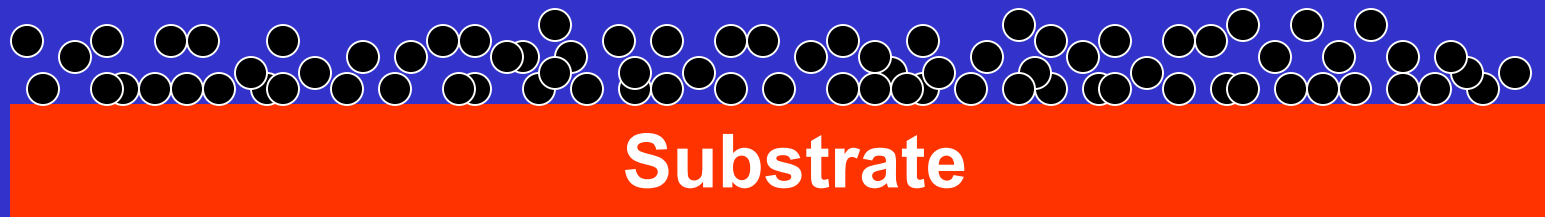
# DPM Builds Up On In-Take Side



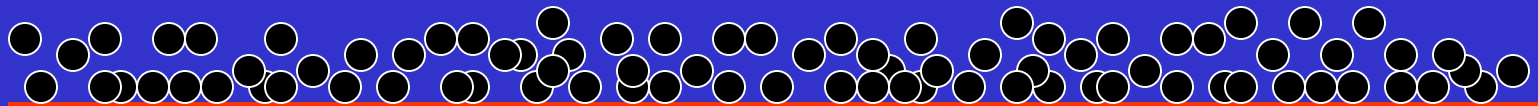
# DPM Builds Up On In-Take Side



# DPM Builds Up On In-Take Side



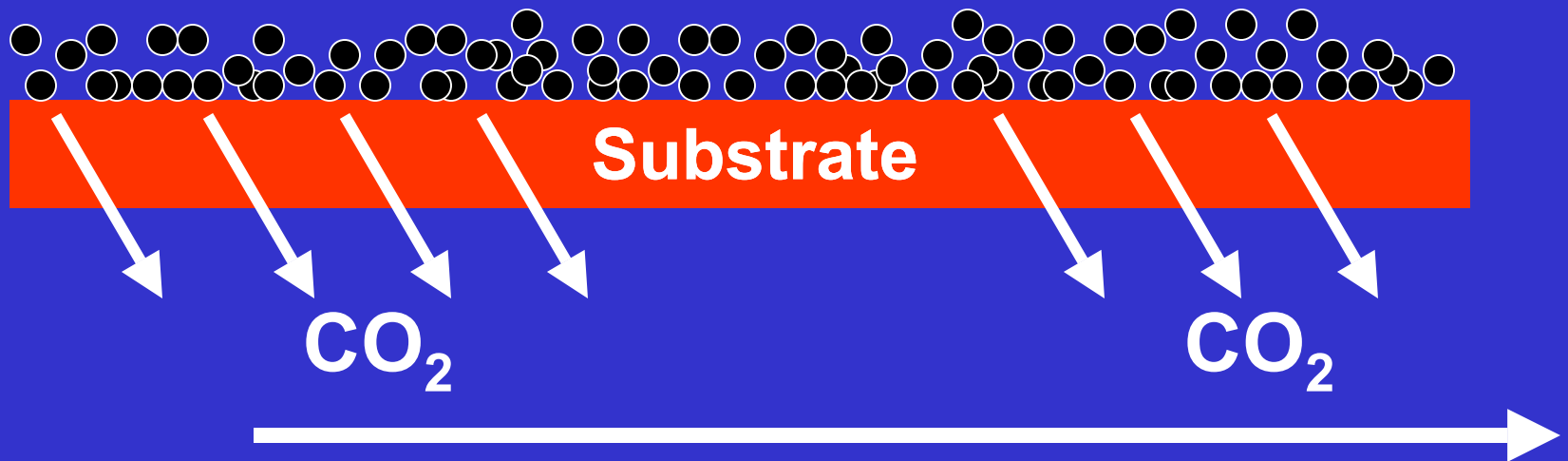
**Back Pressure, Heavy Duty Cycle  
Causes Engine To Work Harder,  
Increasing Exhaust Temperature**



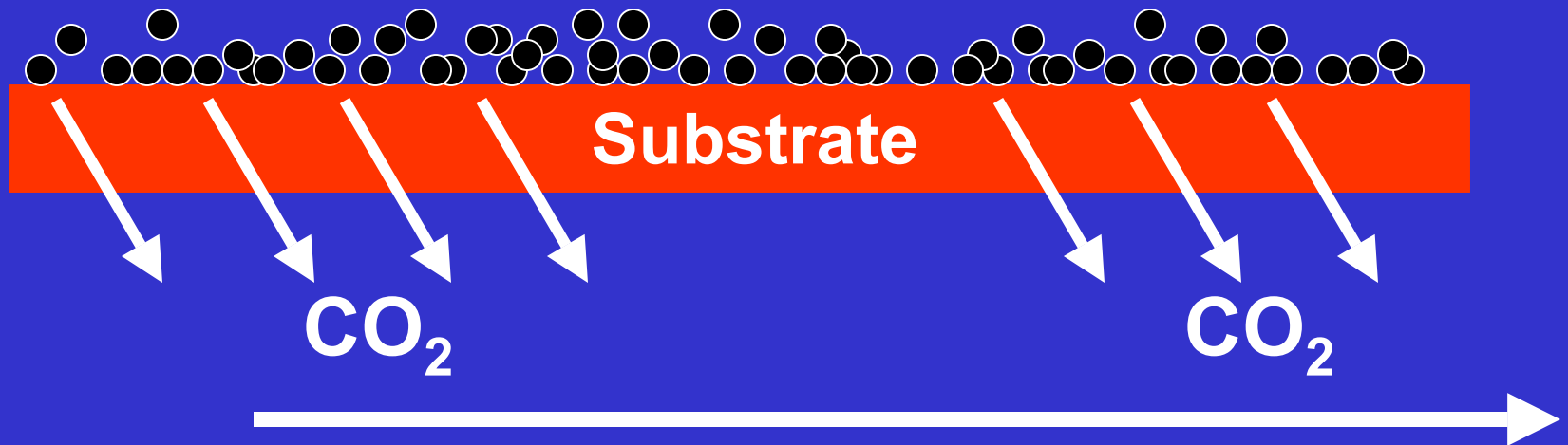
**Substrate**

# Hotter Exhaust Ignites DPM

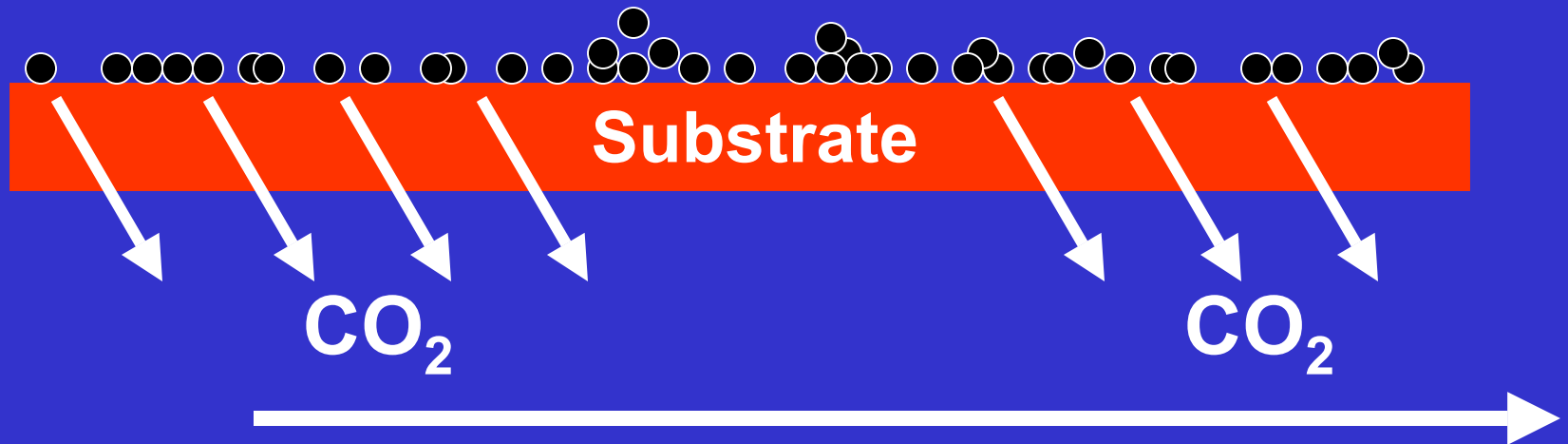
## DPM “Burns Off” Of Substrate



Hotter Exhaust Ignites DPM  
DPM “Burns Off” Of Substrate  
**CO<sub>2</sub> Passes Through Substrate**

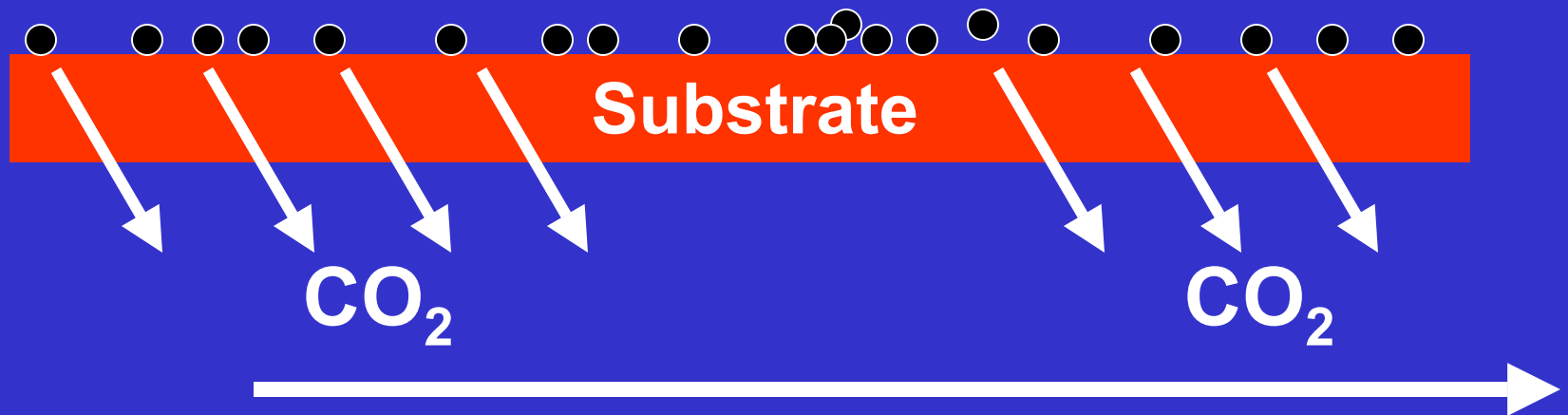


Hotter Exhaust Ignites DPM  
DPM “Burns Off” Of Substrate  
**CO<sub>2</sub> Passes Through Substrate**

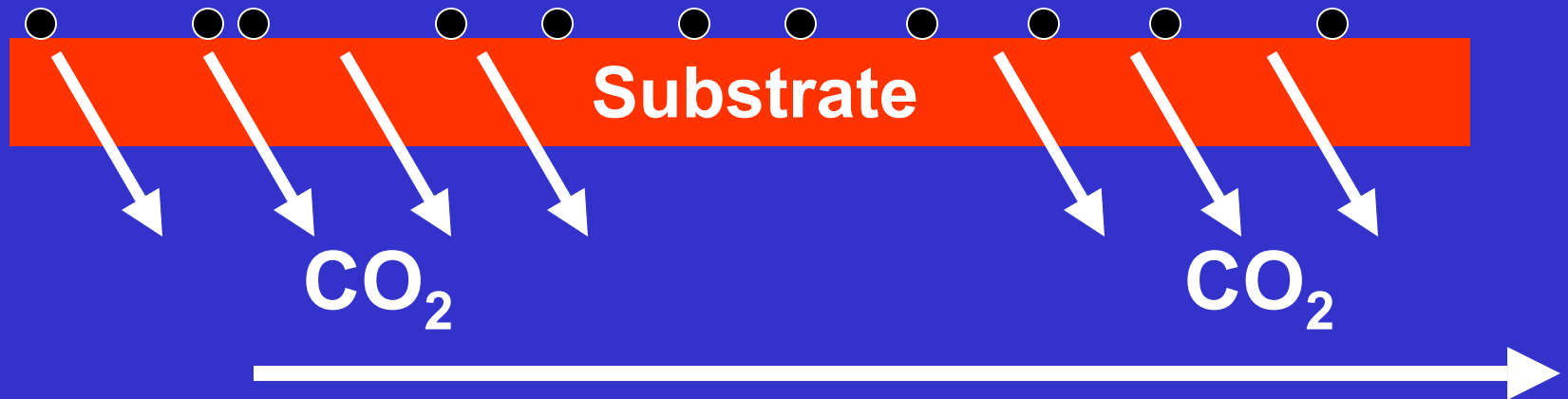




Hotter Exhaust Ignites DPM  
DPM “Burns Off” Of Substrate  
**CO<sub>2</sub> Passes Through Substrate**



Hotter Exhaust Ignites DPM  
DPM “Burns Off” Of Substrate  
**CO<sub>2</sub> Passes Through Substrate**



**DPM Layer Removed**

**Filter Has Been Cleaned**

**Substrate**

# **If Engine Duty Cycle Does Not Produce Sufficient Exhaust Temperature, Controlled Regeneration Does Not Occur**

- ❖ If filter not cleaned, backpressure builds
- ❖ Excessive backpressure can cause serious engine damage (void engine warranty)
- ❖ Uncontrolled regeneration can damage or melt ceramic matrix
- ❖ If **Passive Regeneration** not possible due to low exhaust temperature, need to provide **Active or Active/Passive System** (can be **On-Board** or **Off-Board**)

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - DPM FILTERS**

- ❖ **20+ year history of successful application**
- ❖ **Commercially available for all hp ranges**
- ❖ **Tens of thousands in use on:**
  - **Urban transit buses**
  - **Over-the-road trucks and automobiles**
  - **Fork lift trucks**
  - **Stationary power generation sets**
  - **U/G tunneling and mining equipment**

# §57.5060(a) Interim DPM Limit

## Engineering Controls - DPM FILTERS

- ❖ Unsuccessful use of ceramic filters in MNM mining largely relate to filters that *didn't passively regenerate as expected*
- ❖ Usually reported as “plugged filter” or “caused engine to bog down”
- ❖ Options available in these cases:
  - Mount filter closer to manifold
  - Wrap exhaust pipe with insulation
  - Use active regeneration (on- or off-board)

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - DPM FILTERS**

- ❖ Mine operators are urged to consult with engine manufacturer and filter supplier prior to specifying, purchasing or installing a filter on a given machine used in a given application**
- ❖ MSHA can also provide compliance assistance, including filter selection and troubleshooting flowchart**

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - NEW ENGINES**

- ❖ **New technology diesel engines can greatly reduce DPM emissions**
- ❖ **For a 100 HP engine:**
  - **Old “high polluting” model could emit over 1 gram per hour of operation**
  - **New “low emission” model could emit less than 1/20 gram per hour**

**Over 95% reduction in DPM emission**



# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - CABS**

- ❖ **Environmental cabs with filtered breathing air reduce DPM for operator**
- ❖ **Cabs often available for new equipment, also available for some older equipment**
- ❖ **Cab should be pressurized**
- ❖ **Should use HEPA filter**
- ❖ **Keep doors and windows closed, maintain door seals and gaskets**
- ❖ **Miners outside cabs not protected**

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - VENTILATION**

- ❖ **DPM reduction proportional to air flow**
- ❖ **Main and auxiliary ventilation**
- ❖ **Boosting air flow a good start, but also need to direct air where needed**
  - **Stop short circuits**
  - **Stop recirculation**
- ❖ **May need to consult with mine ventilation specialist**

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - FUELS**

- ❖ **Alternate fuels may reduce DPM**
- ❖ **Diesel-water emulsions**
- ❖ **Fuel additives**
  - **Cetane boosters, oxygenated additives, Detergents, surfactants, lubricity additives**
- ❖ **Bio-diesel, soy-diesel**
- ❖ **Consult with engine manufacturer**

# **§57.5060(a) Interim DPM Limit**

## **Engineering Controls - REMOTE CONTROL**

- ❖ **Compliance may be difficult in certain areas with limited access to ventilation**
- ❖ **Equipment operator can control equipment from location with better air quality or from environmental booth supplied with filtered air**
- ❖ **Remotely controlled LHD's and haulage trucks commercially available**
- ❖ **Useful at end of series ventilation system**

# **§57.5060(a) Interim DPM Limit**

## **Administrative Controls - JOB ROTATION**

- ❖ **Job rotation prohibited as means of compliance**
- ❖ **For carcinogens, job rotation spreads hazard to more miners**

# **§57.5060(a) Interim DPM Limit**

## **Administrative Controls - IDLING ENGINES**

- ❖ **Prohibiting unnecessary idling reduces DPM emissions**
- ❖ **Was included in DPM Proposed Rule, but removed for final rule**
- ❖ **Still a good idea**

# **§57.5060(a) Interim DPM Limit**

## **Administrative Controls - LUGGING**

- ❖ **Operating diesel under low speed and high load conditions (lugging) produces high levels of DPM**
- ❖ **Normally a problem with older equipment**
- ❖ **Train equipment operators to avoid lugging engines**

# **§57.5060(a) Interim DPM Limit**

## **Administrative Controls - TRAFFIC RULES**

- ❖ **Speed limits, one-way travel can reduce DPM exposures**
- ❖ **Designate areas that are “off limits”**
- ❖ **Limit number of machines or total horsepower permitted in ventilation split or area at high risk of DPM overexposure**
  - **Especially important in series ventilation**
- ❖ **Train equipment operators accordingly**



# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter
- § 57.5061 Compliance determinations**
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
- § 57.5066 Maintenance standards
- § 57.5067 Engines
- § 57.5070 Miner training
- § 57.5071 Environmental monitoring
- § 57.5075 Diesel particulate records

# **§57.5061 Compliance Determinations**

- ❖ **MSHA will determine compliance with interim limit by single sample, as follows:**
  - **Personal exposures (no area samples)**
  - **Full shift basis**
  - **Shift-weighted (8-hr equivalent)**
  - **10mm Dorr-Oliver nylon cyclone**
  - **SKC DPM sample cassette with integral submicron impactor and tandem quartz fiber filters**
  - **Sample analyzed for total carbon (TC) per NIOSH Method 5040**



**SKC DPM filter cassette with  
submicron impactor and quartz fiber filters**



**DPM Filter Cassette Mounted  
On Cyclone In Lapel Holder**

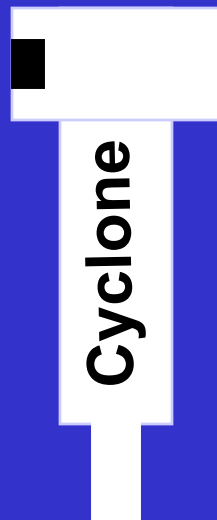




**Personal Sampling For DPM In Gypsum Mine**

# DPM Sampling

Collect Only Submicron Particulates



# DPM Sampling

Collect Only Submicron Particulates

**Submicron  
Impactor**

**Cyclone**

A schematic diagram of a DPM sampling device. It consists of a green rectangular box at the top labeled "Submicron Impactor". Below this box is a white rectangular component with a small black square on its left side. A vertical white tube, labeled "Cyclone", extends downwards from the white component. The entire assembly is set against a solid blue background.

# DPM Sampling

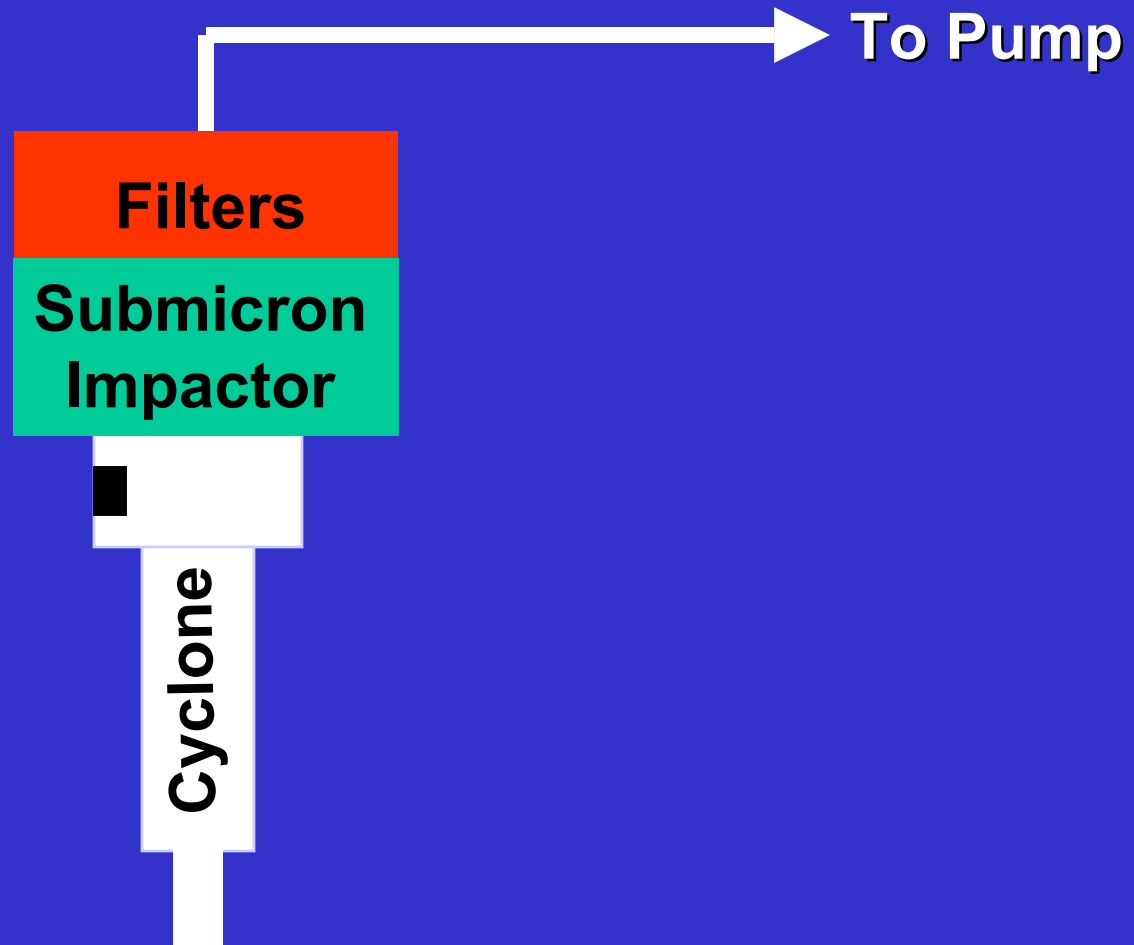
Collect Only Submicron Particulates





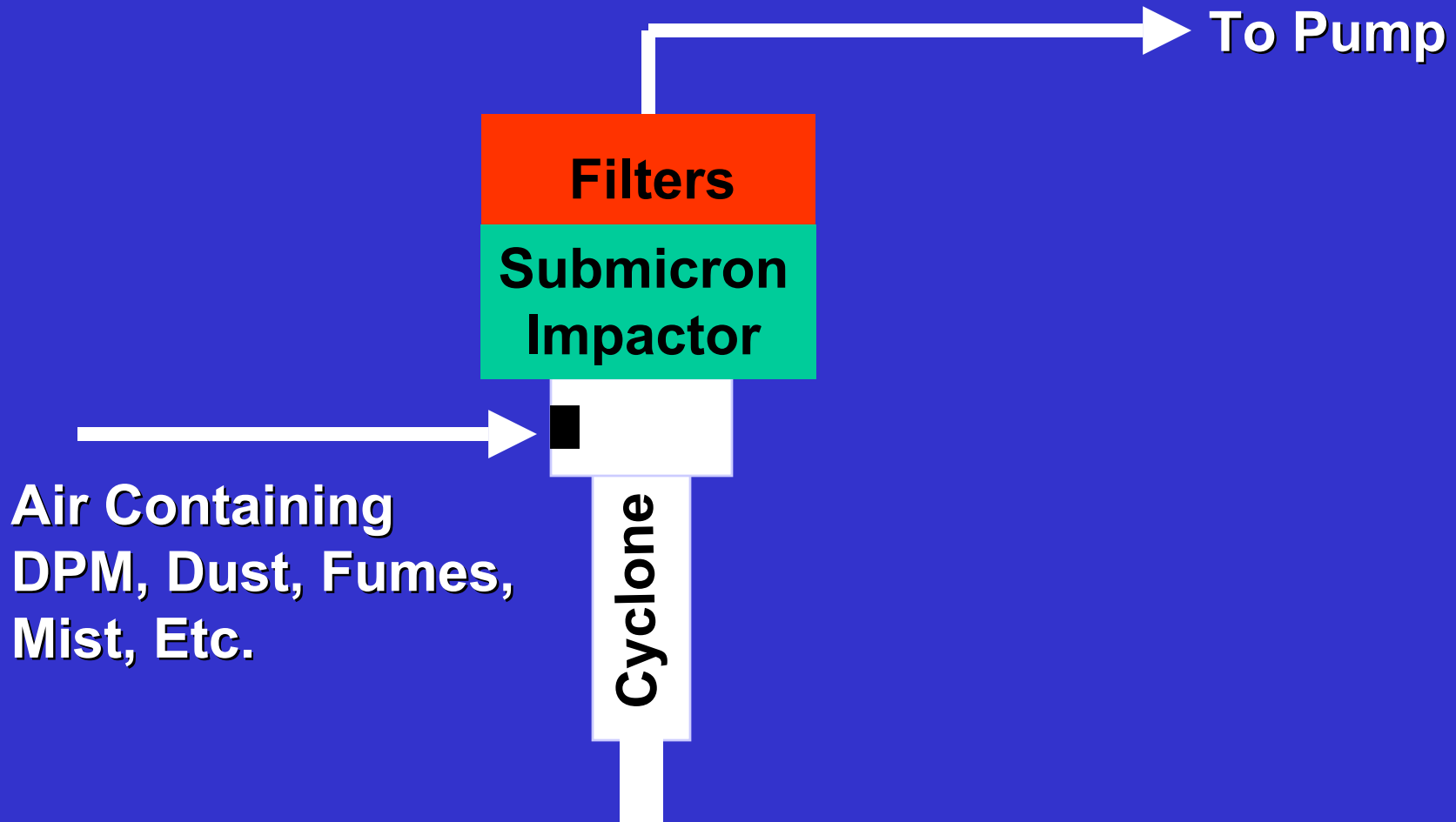
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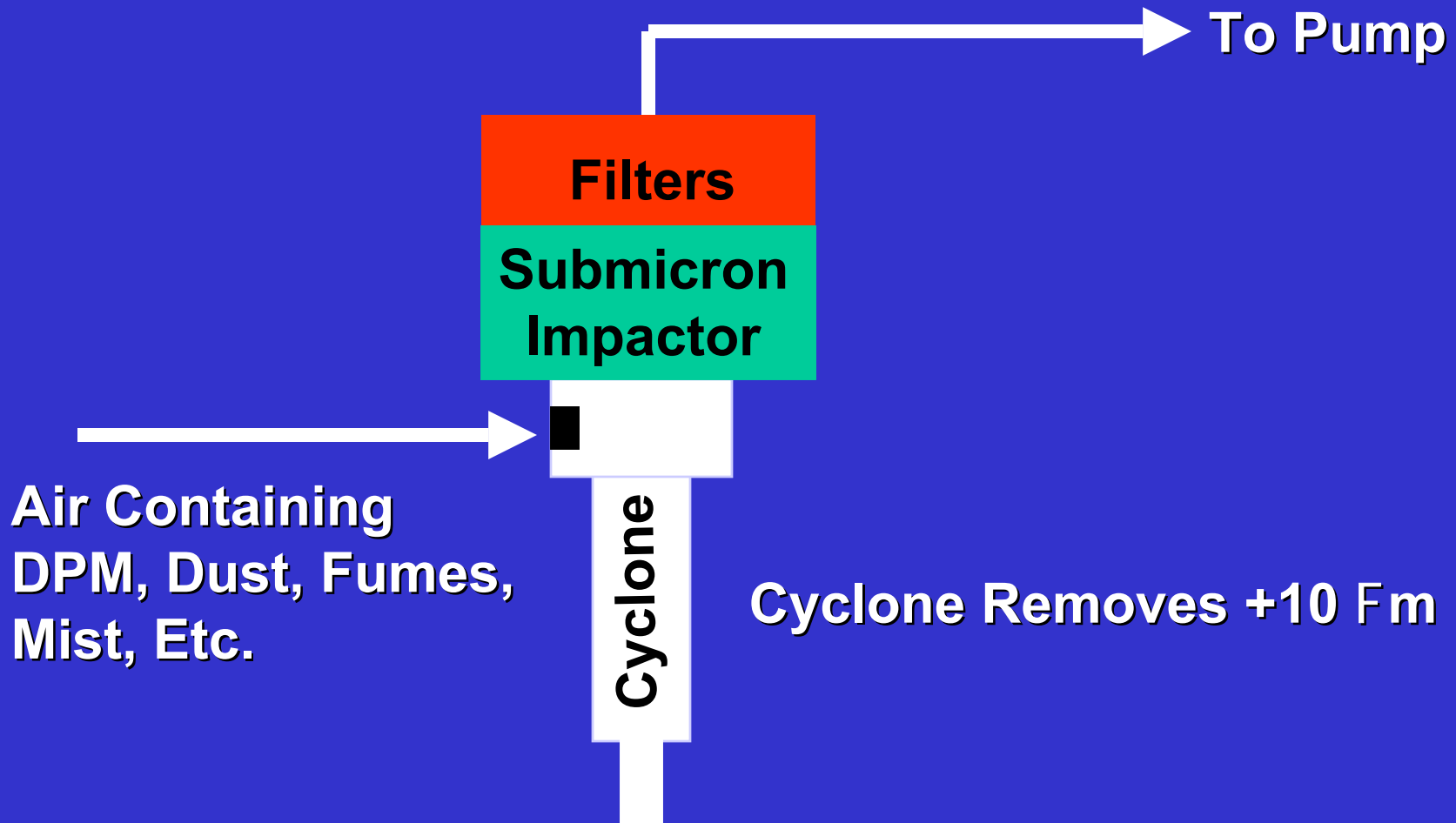
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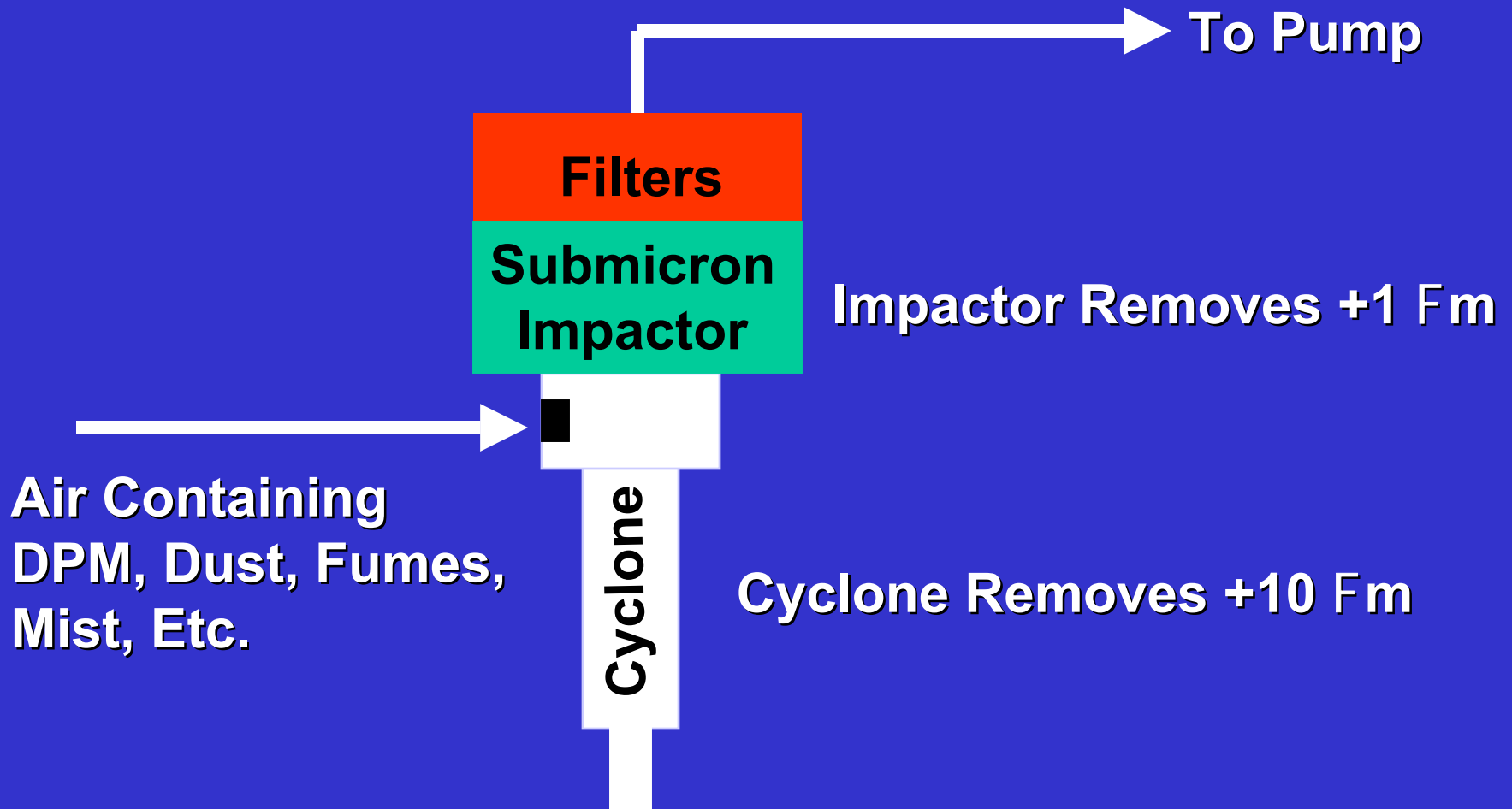
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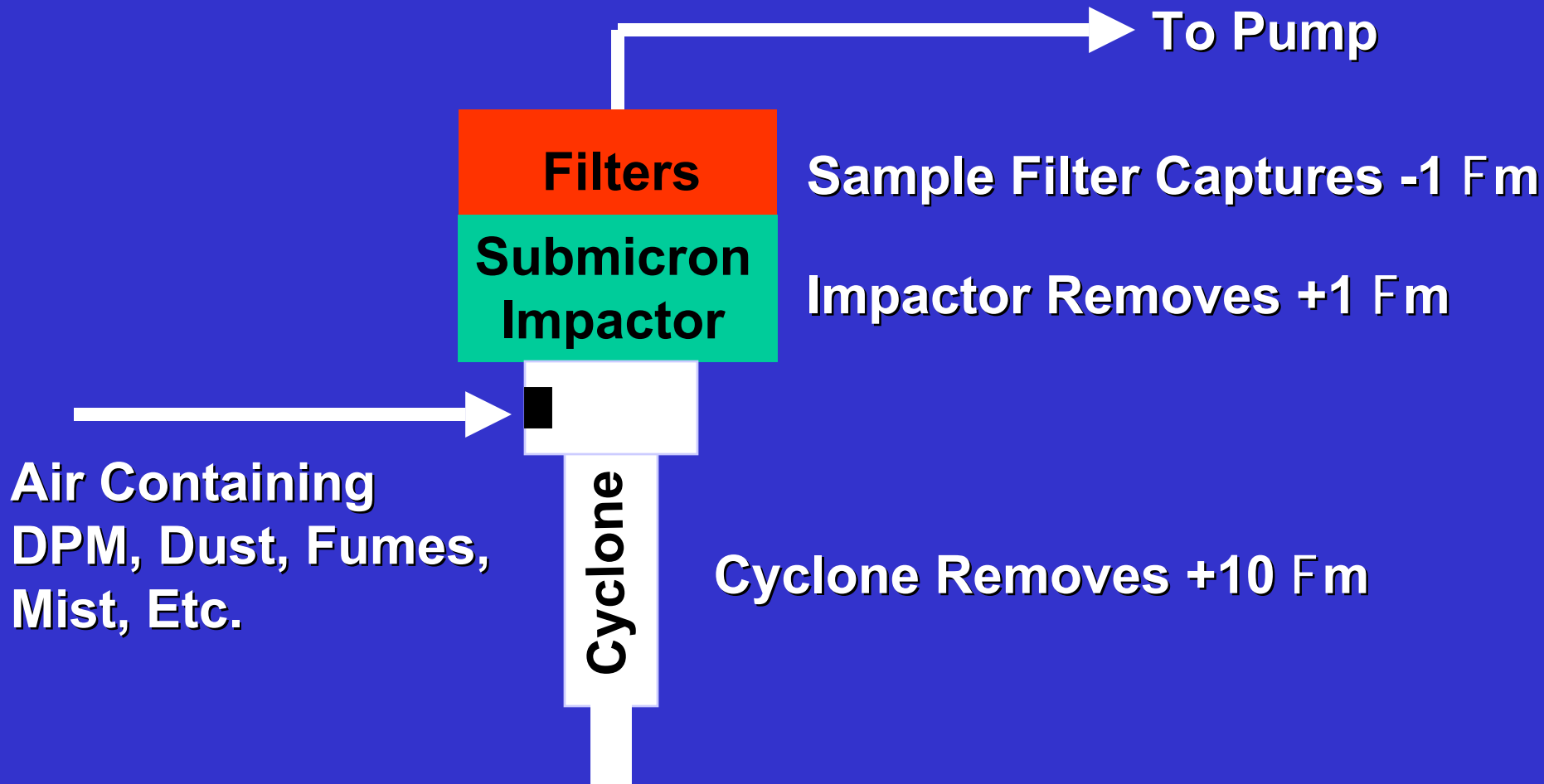
# DPM Sampling

Collect Only Submicron Particulates



# DPM Sampling

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# DPM Sampling

Collect Only Submicron Particulates

**Filters**

Sample Filter Captures -1 Fm

# DPM Sampling

Collect Only Submicron Particulates

**Filters**

Sample Filter Captures -1 Fm

Send Filter Cassette To Lab For Analysis

# **DPM Sampling**

**Collect Only Submicron Particulates**

**Filters**

**Sample Filter Captures -1 Fm**

**Send Filter Cassette To Lab For Analysis**

**Lab Analyzes Sample Filter For Total Carbon**



# **DPM Sampling**

**Collect Only Submicron Particulates**

**Filters**

**Sample Filter Captures -1 Fm**

**Send Filter Cassette To Lab For Analysis**

**Lab Analyzes Sample Filter For Total Carbon**

**Control Filter Analyzed If Necessary**

# **§57.5061 Compliance Determinations**

- ❖ Sampling and analysis for total carbon per this procedure satisfies NIOSH Accuracy Criterion**

# **§57.5061 Compliance Determinations**

## **❖ Determining Total Carbon Concentration**

- NIOSH Method 5040 produces separate results for Elemental Carbon (EC) and Organic Carbon (OC)**
- $EC + OC = TC$**
- Due to possible interference from other carbon sources in mine (tobacco smoke, drill oil mist), OC may contain carbon other than from DPM**
- $EC \times 1.3 = TC$**
- $EC \times 1.3$  reasonable estimate of TC**

# §57.5061 Compliance Determinations

## ❖ Determining Total Carbon Concentration

- NIOSH Method 5040 produces separate analytic results for Elemental Carbon (EC) and Organic Carbon (OC)
- $EC + OC = TC$
- Due to possible interference from other carbon sources in mine (tobacco smoke, drill oil mist), OC may contain carbon other than from DPM
- $EC \times 1.3 = TC$
- $EC \times 1.3$  reasonable estimate of TC

# §57.5061 Compliance Determinations

## ❖ Determining Total Carbon Concentration

- 2 values for total carbon
  - ◆  $EC + OC = TC$
  - ◆  $EC \times 1.3 = TC$
- Compliance determination based on Lower of the 2 values
- Using lower of 2 values insures compliance determination not affected by potential interferences

# **§57.5061 Compliance Determinations**

- ❖ **Violations of the interim DPM limit will be cited only if measured DPM concentration exceeds the limit by a sufficient margin to insure, at 95% confidence level, that miner was actually overexposed**
  - **Compliance determination must take into account normal sampling and analytical errors, referred to as error factor**
- ❖ **Error factor for  $EC + OC = TC$  is 1.14**
- ❖ **Error factor for  $EC \times 1.3 = TC$  is 1.12**

# §57.5061 Compliance Determinations

❖ Limit x Error Factor = Enforceable Limit

❖ Enforceable interim DPM limit for  
EC + OC = TC is:

$$400_{TC} \mu\text{g}/\text{m}^3 \times 1.14 = 456_{TC} \mu\text{g}/\text{m}^3$$

❖ Enforceable interim DPM limit for  
EC x 1.3 = TC is:

$$400_{TC} \mu\text{g}/\text{m}^3 \times 1.12 = 448_{TC} \mu\text{g}/\text{m}^3$$

❖ Citable violation only if both TC values  
exceed their respective enforceable limit

# Provisions effective July 20, 2002

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- § 57.5075 Diesel particulate records



## **§ 57.5065 (a) & (b) Fueling Practices**

- ❖ Diesel Fuel Used To Power Equipment In Underground Areas Limited To Sulfur Content Of 0.05%**
- ❖ Operator Must Retain Purchase Records Noting Sulfur Content For 1 Yr**
- ❖ Fuel Additives Must Be Registered With U.S. Environmental Protection Agency**

# **As Published on January 19, 2001, Regulation Had An Error**

## **§57.5065 Fueling practices**

**Paragraph (c) restricting idling was erroneously included in Final Rule. It has since been removed from Final Rule consistent with the preamble language published on January 19, 2001, clearly stating that MSHA was deleting it.**

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## **§ 57.5066 (a) Maintenance Standards**

- ❖ Approved Engines Must Be Maintained In Approved Condition**
- ❖ Emissions-Related Components Of Non-Approved Engines Must Be Maintained According To Manufacturer Spec's**
- ❖ Emissions Or Particulate Control Devices Must Be Maintained In Effective Operating Condition**

# **Engine & Emission System Maintenance**

## **❖ Engine And Emission Control System Maintenance Affects DPM Emissions**

## **❖ Key Maintenance Items Include:**

- Pistons & Cylinder Head**
- Intake & Exhaust Valves**
- Injectors & Fuel Injection Pump**
- Governor**
- Turbocharger, Aftercooler**
- Injection Timing**
- Fuel Pump Calibration**
- Filter Media/Matrix**

## **§ 57.5066 (b) Maintenance Standards**

- ❖ Equipment operators must be authorized and required to affix a visible and dated tag at any time they note any evidence that the equipment may need maintenance per § 57.5066 (a)**
- ❖ Equipment tagged under § 57.5066 (b) must be promptly examined by person authorized to maintain diesel equipment**
- ❖ Tag cannot be removed until examination**
- ❖ Mine operator must maintain log of tags**

# § 57.5066 (b) Maintenance Standards

- ❖ Equipment operators must be authorized and required to affix a visible and dated tag at any time they note any **evidence** that the equipment may need maintenance per § 57.5066 (a)

## § 57.5066 (b) Maintenance Standards

- ❖ Equipment operators must be authorized and required to affix a visible and dated tag at any time they note any **evidence** that the equipment may need maintenance per § 57.5066 (a)
- ❖ “Evidence” means visible smoke or odor that is unusual for that piece of equipment under normal operating procedures, or obvious or visible defects in the exhaust emissions control system or in the engine affecting emissions



# § 57.5066 (b) Maintenance Standards

- ❖ Equipment tagged under § 57.5066 (b) must be promptly examined by person authorized to maintain diesel equipment

# § 57.5066 (b) Maintenance Standards

- ❖ Equipment tagged under § 57.5066 (b) must be **promptly** examined by person authorized to maintain diesel equipment
- ❖ “Promptly” means before the end of the next shift during which a qualified mechanic is scheduled to work

# **§ 57.5066 (b) Maintenance Standards**

- ❖ **Equipment tagged per § 57.5066 (b) does not need to be immediately removed from service**

*§ 57.5066 (b) tag not the same as a § 57.14100(c) tag, which relates to safety defects*

- ❖ **Mine operators should choose distinctive tag color, shape, etc. to prevent confusion**

## **§ 57.5066 (c) Maintenance Standards**

- ❖ Persons Authorized To Maintain Diesel Equipment Must Be Qualified By Virtue Of Training Or Experience**
- ❖ Mine Operator Must Retain “Appropriate Evidence Of The Competence” Of Any Person Who Performs Specific Maintenance Tasks Per The Maintenance Standards**
- ❖ “Appropriate Evidence” Must Be Retained For 1 Yr After Any Maintenance**

# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter
- § 57.5061 Compliance determinations
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
- § 57.5066 Maintenance standards
- § 57.5067 Engines**
- § 57.5070 Miner training
- § 57.5071 Environmental monitoring
- § 57.5075 Diesel particulate records

# **§ 57.5067 (a) Engines**

- ❖ Any Diesel Engine Introduced Underground After March 20, 2001 Must Either:**
  - (a)(1) Have Affixed A Plate Evidencing Approval Under Subpart E of Part 7, Or Under Part 36**
  - (a)(2) Meet Or Exceed The Applicable PM Emission Requirements Of The U.S. EPA Listed In Table 57.5067-1**

# § 57.5067 (a) Engines

❖ Any Diesel Engine Introduced Underground After **March 20, 2001** Must Either:

- (a)(1) Have Affixed A Plate Evidencing Approval Under Subpart E of Part 7, Or Under Part 36
- (a)(2) Meet Or Exceed The Applicable PM Emission Requirements Of The U.S. EPA Listed In Table 57.5067-1

## **§ 57.5067 (a) Engines**

- ❖ MSHA conducted physical inventories of engines in all U/G MNM mines by engine serial number (completed 9/30)**
- ❖ Engines introduced underground after a mine's physical inventory must either be MSHA Approved or meet the EPA emissions specifications outlined in Table 57.5067-1**
- ❖ The March 20, 2001 date referenced in the standard is not binding**



# § 57.5067 (b) Engines

- ❖ “Introduced” means any engine added to the underground inventory of engines:
  - Engine in newly purchased equipment
  - Engine in used equipment brought into mine
  - Replacement engine that has different serial number than the one it is replacing
- ❖ “Introduced” *does not include* engine previously in mine inventory and rebuilt (must have same S/N), or engine transferred from another U/G mine operated by same mine operator

# **Exceptions From § 57.5067 Engine Requirements**

- ❖ Engines In Ambulances And Fire Fighting Equipment Used In Accordance With Mine Fire Fighting And Evacuation Plans Are Exempt From Engine Standards**

# **What Is An MSHA Approved Engine Per 57.5067(a)(1) ?**

- ❖ An Engine Approved Under Part 7 Or Part 36, Title 30 CFR**
- ❖ Laboratory Testing Verifies Emissions**
- ❖ Engine Manufacturer Holds Approval**
- ❖ Approved Engines Have Approval Tag**
- ❖ MSHA Lists Approved Engines At:**  
<http://www.msha.gov/S&HINFO/DESLREG/1909a.HTM>
- ❖ “Old” Part 32 (Schedule 24) Certification Not Acceptable**

# **MSHA Will Accept Any Of The Following To Demonstrate Compliance With §57.5067(a)(2):**

- ❖ **Light Duty Vehicle/Truck Or Heavy Duty Engine (Passenger Cars, Pick-up Trucks, On-Road Dump Trucks) Model Year 1994 Or Later**

# § 57.5067(a)(2) Engines

## EPA Emission Requirements

### EPA Category

### PM Limit

Light Duty Vehicle/Truck		0.1 g/mile
Heavy Duty Highway Engine		0.1 g/bhp-hr
Nonroad Engines		
Tier 1	Less Than 11 hp	0.75 g/bhp-hr
Tier 1	11 hp To < 50 hp	0.60 g/bhp-hr
Tier 2	50 hp To < 100 hp	0.30 g/bhp-hr
Tier 2	100 hp To < 175 hp	0.22 g/bhp-hr
Tier 1	175 hp To 750 hp	0.40 g/bhp-hr

# **MSHA Will Accept Any Of The Following To Demonstrate Compliance With §57.5067(a)(2):**

- ❖ **Light Duty Vehicle/Truck Or Heavy Duty Engine (Passenger Cars, Pick-up Trucks, On-Road Dump Trucks) Model Year 1994 Or Later**
- ❖ **EPA Labeled Non-Road Engines If The Information On The Label Matches Table 57.5067-1**

# § 57.5067(a)(2) Engines

## EPA Emission Requirements

### EPA Category

### PM Limit

Light Duty Vehicle/Truck		0.1 g/mile
Heavy Duty Highway Engine		0.1 g/bhp-hr
Nonroad Engines		
Tier 1	Less Than 11 hp	0.75 g/bhp-hr
Tier 1	11 hp To < 50 hp	0.60 g/bhp-hr
Tier 2	50 hp To < 100 hp	0.30 g/bhp-hr
Tier 2	100 hp To < 175 hp	0.22 g/bhp-hr
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- ❖ **Light Duty Vehicle/Truck Or Heavy Duty Engine (Passenger Cars, Pick-up Trucks, On-Road Dump Trucks) Model Year 1994 Or Later**
- ❖ **EPA Labeled Non-Road Engines If The Information On The Label Matches Table 57.5067-1**
- ❖ **DPM Emissions Data Indicating Compliance With The PM Limits In Table 57.5067-1 (Engine Manufacturer or Other Sources)**



# **MSHA Will Accept Any Of The Following To Demonstrate Compliance With §57.5067(a)(2):**

- ❖ **Light Duty Vehicle/Truck Or Heavy Duty Engine (Passenger Cars, Pick-up Trucks, On-Road Dump Trucks) Model Year 1994 Or Later**
- ❖ **EPA Labeled Non-Road Engines If The Information On The Label Matches Table 57.5067-1**
- ❖ **DPM Emissions Data Indicating Compliance With The PM Limits In Table 57.5067-1 (Engine Manufacturer or Other Sources)**
- ❖ **Engine Certified From International Source That Indicates Compliance With The PM Limits In Table 57.5067-1 (Obtain From Engine Manufacturer)**

# EPA Emission Requirements

## EPA Category

## PM Limit

Light Duty Vehicle/Truck		0.1 g/mile
Heavy Duty Highway Engine		0.1 g/bhp-hr
Nonroad Engines		
Tier 1	Less Than 11 hp	0.75 g/bhp-hr
Tier 1	11 hp To < 50 hp	0.60 g/bhp-hr
Tier 2	50 hp To < 100 hp	0.30 g/bhp-hr
Tier 2	100 hp To < 175 hp	0.22 g/bhp-hr
Tier 1	175 hp To 750 hp	0.40 g/bhp-hr

# EPA Emission Requirements

## EPA Category

## PM Limit

Light Duty Vehicle/Truck		0.1 g/mile
Heavy Duty Highway Engine		0.1 g/bhp-hr
Nonroad Engines		
Tier 1	Less Than 11 hp	0.75 g/bhp-hr
Tier 1	11 hp To < 50 hp	0.60 g/bhp-hr
Tier 2	50 hp To < 100 hp	0.30 g/bhp-hr
Tier 2	100 hp To < 175 hp	0.22 g/bhp-hr
Tier 1	175 hp To 750 hp	0.40 g/bhp-hr

***Contact MSHA For Assistance***

# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter
- § 57.5061 Compliance determinations
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
- § 57.5066 Maintenance standards
- § 57.5067 Engines
- § 57.5070 Miner training**
- § 57.5071 Environmental monitoring
- § 57.5075 Diesel particulate records

# **§ 57.5070 Miner Training**

- ❖ Annual DPM Training Required For All Miners Who Can “Reasonably Be Expected To Be Exposed” To DPM**
- ❖ Annual training means:**
  - Initial DPM training had to be completed by July 5, 2001**
  - Annual training within every 12 months thereafter**
- ❖ No provisions for new miner, newly hired experienced miner, or new task training**
- ❖ Record of training retained for 1 yr**

# § 57.5070 Miner Training

- ❖ Standard **Does Not** Specify Training Format, Duration, Location
- ❖ Standard **Does** Specify Training Content:
  - Health Risks Of DPM Exposure
  - Methods Used To Control DPM In Mine  
*Fuel, Maintenance, Engines, Ventilation, Work Practices, CC's, Filters, Etc.*
  - Identify Persons Responsible For Maintaining DPM Controls
  - Actions Miners Must Take To Ensure Control Function Properly

# **§ 57.5070 Miner Training**

- ❖ DPM Training May, But Is Not Required To Be Combined Into Part 48 Training**
- ❖ If DPM Training Is Combined Into Part 48 Training, All Part 48 Requirements Apply (Approved Plan, Certification On 5000-23 form, MSHA-Certified Instructors, Etc.)**
- ❖ If DPM Training Is Separate From Part 48 Training, Part 48 Requirements Do Not Apply**

# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter
- § 57.5061 Compliance determinations
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
- § 57.5066 Maintenance standards
- § 57.5067 Engines
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- § 57.5071 Environmental monitoring**
- § 57.5075 Diesel particulate records



# **§ 57.5071 Environmental Monitoring**

- ❖ **Mine operators must monitor as often as necessary to effectively determine:**
  - **If any miners are overexposed to DPM**
- ❖ **Mine operator must give prior notice of any monitoring per § 57.5071**
- ❖ **If overexposure identified, mine operator must promptly post notice of, and promptly complete corrective action**

# **§ 57.5071 Environmental Monitoring**

- ❖ All monitoring results (including MSHA compliance sampling) must be posted within 15 days, and must remain posted 30 days**
- ❖ Copy of monitoring results must be provided to miner's representative**
- ❖ Monitoring results and information on method of monitoring must be retained for 5 years from date of sampling**

# § 57.5071 Environmental Monitoring

- ❖ Mine operators not required to utilize MSHA compliance sampling method

*Note that monitoring requirement refers to DPM, not TC*

- ❖ Frequency of monitoring not specified

*Monitoring must be as often as necessary to verify continuing compliance*

- ❖ Any sampling method (including area)  
OK if related to miner exposure to TC

# § 57.5071 Environmental Monitoring

- ❖ MSHA will not cite based on mine operator's monitoring
  - *Citations for overexposure to interim limit based on MSHA compliance sampling only*
  - *MSHA would cite only if mine operator monitoring indicated an overexposure, and no corrective action taken*
- ❖ All equipment and supplies for MSHA compliance sampling are available
- ❖ At least 6 commercial labs perform NIOSH 5040 analysis for total carbon

# **§ 57.5071 Environmental Monitoring**

- ❖ Compliance assistance is available for any mine operator who needs help with sampling**

# Provisions effective July 20, 2002

- § 57.5060 Limit on the concentration of diesel particulate matter
- § 57.5061 Compliance determinations
- § 57.5062 Diesel particulate matter control plan
- § 57.5065 Fueling practices
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- § 57.5075 Diesel particulate records**

## **§ 57.5075 Diesel Particulate Records**

**Required DPM records for provisions  
that are effective as of July 20, 2002:**

<b><u>Record</u></b>	<b><u>Retention Time</u></b>
1. Fuel purchase records noting sulfur content	Purchase date + 1 yr
2. Maintenance log (tagging)	Date equipment tagged + 1 yr
3. Evidence of competence to perform diesel maintenance yr	Date maintenance performed + 1 yr
4. Annual training for miners potentially exposed to DPM	Training date + 1 yr
5. Environmental monitoring	Sample date + 5 yrs

# **§ 57.5075 Diesel Particulate Records**

- ❖ Required Records Must Be Kept At Mine**
  - May Be Kept Off-Site If Immediately Accessible Through Electronic Transmission**
- ❖ Operator Must Provide MSHA, NIOSH, And Miner's Rep Access To All Records Without Unnecessary Delay**
- ❖ Operator Ceasing Business Must Provide Records To Successor Operator**



# **Provisions effective July 20, 2002**

- § 57.5060 Limit on the concentration of diesel particulate matter**
- § 57.5061 Compliance determinations**
- § 57.5062 Diesel particulate matter control plan**
- § 57.5065 Fueling practices**
- § 57.5066 Maintenance standards**
- § 57.5067 Engines**
- § 57.5070 Miner training**
- § 57.5071 Environmental monitoring**
- § 57.5075 Diesel particulate records**

# **Additional Requirements Per Settlement Agreement**

- ❖ **MSHA will provide compliance assistance until July 19, 2003 on:**
  - **Baseline DPM sampling**
  - **Information on feasible DPM controls**
- ❖ **Operators must have written compliance strategy**
  - **Sampling to determine DPM levels**
  - **Develop plan for engineering controls**
  - **Schedule acquisition and installation of controls**

# **Additional Requirements Per Settlement Agreement**

- ❖ **Violations of interim limit will not be cited based on compliance assistance sampling conducted on or prior to July 19, 2003**
  - **Contingent on mine operator making good faith efforts regarding MSHA compliance assistance and developing written compliance strategy**
  - **MSHA retains discretion to take appropriate enforcement action (compliance sampling, violations to be cited) against operators who do not take good faith steps to develop and implement written compliance strategy for their mines**

QUESTIONS

**Bill Pomroy**

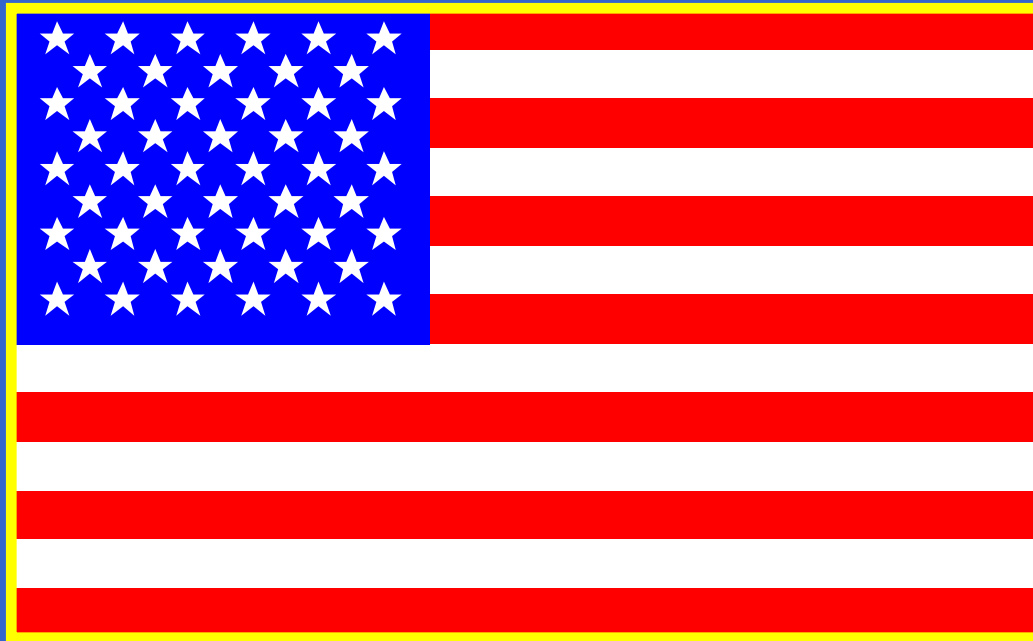
**MSHA - North Central District**

**515 W. First St.**

**Duluth, MN 55802-1302**

**218-720-5448**

# Thank You



# Fueling Practices

❖ Is Low Sulfur Diesel Fuel Commercially Available?

Yes. Throughout The U.S.

Required For On-Highway Since 1993 (EPA).

Required in U/G Coal Mines Since 1996 (MSHA).

❖ Can Low Sulfur Fuel Be Differentiated By Color?

No. Non-Highway Fuel May Be Dyed To Differentiate For Road-Use Taxes, But Could Be High Or Low Sulfur.

All On-Highway Diesel Fuel (Not Dyed) Is Low Sulfur (0.05% Sulfur Or Less).

# Fueling Practices

❖ How Will I Know Sulfur Content Of Fuel?

**Need Documentation From Fuel Supplier.**

**Must Retain Purchase Records For 1 Year.**

❖ Does Diesel Fuel Purchased Before July 5, 2001 Have To Be Low Sulfur?

**No.**

❖ Why Must Fuel Additives Be Registered With EPA?

**Insures Additives Won't Inadvertently Increase Particulates Or Include Other Toxic Constituents.**



# Maintenance Practices

## ❖ In What Condition Must I Maintain My Diesel Engines?

**The Requirements Of The Standard Must Be Followed:**

- **Approved Engines Maintained In Approved Condition.**
- **Emission Related Components Of Non-Approved Engines Maintained According To Manf. Spec's.**
- **Emission Control Devices Maintained In Effective Operating Condition.**

# Maintenance Practices

- ❖ What If Equipment Is Maintained Or Repaired Off-Site, And Then Returned To The Mine?

**All Maintenance Provisions Still Apply.**

- ❖ Will I Need To Tear Down An Engine To Prove Maintenance Is In Strict Accordance With Standard?

**No. If Violation Suspected, MSHA Will Check Manuals, Talk With Mechanics, May Bring In MSHA Diesel Expert.**

# Maintenance Practices

- ❖ Will MSHA Check The Qualifications Of Persons Performing Maintenance If There Does Not Appear To Be A Maintenance Problem Affecting DPM Emissions?

**No.**

- ❖ If A Diesel Engine Requires Frequent Maintenance, Will MSHA Automatically Cite The Operator For Having An Unqualified Person Perform The Maintenance?

**No. The Fact That An Engine Requires Frequent Maintenance, Does Not Necessarily Mean That Maintenance Was Performed By An Unqualified Person.**

# Maintenance Practices

## ❖ What Is Meant By “Qualified”?

**Person Performing Maintenance Task Must Have Training Or Experience Commensurate With The Task Being Performed.**

- **Truck Driver Changing Air Filter May Need Little Or No Training.**
- **Mechanic Rebuilding Engine May Need Tech School, Apprenticeship, Manf. Rep Training, Applicable On-The-Job Experience, Etc.**

# Maintenance Practices

- ❖ **What Evidence Does An Operator Have To Have To Show A Person Is Qualified To Perform Specific Maintenance Tasks On Diesel Equipment**

**The Standard Does Not Specify The Type Of Record That Is Required. A Record Of Employment Experience Or A Certificate Of Training Would Be Appropriate.**

# Maintenance Practices

- ❖ If Maintenance Is Performed By An Independent Contractor, Does “Qualification” Provision Still Apply?

**Yes.**

- ❖ Do Maintenance Standards Apply Only To MSHA Approved Or EPA Compliant Engines?

**No. All Diesel Engines Are Covered.**

# Engines

- ❖ Do Engines That Were Introduced On Or Before July 5, 2001 Have To Be MSHA Approved Or EPA Compliant?

**No.**

- ❖ Do Engines That Were Purchased On Or Before July 5, 2001 For Delivery After July 5, 2001 Have To Be MSHA Approved Or EPA Compliant?

**No.**

# Engines

- ❖ Do Engines In Independent Contractor Vehicles Need To Be MSHA Approved Or EPA Compliant?

**Yes, Unless They Were Introduced On Or Before July 5, 2001.**

- ❖ How Will MSHA Determine When A Non-Approved, Non-EPA Compliant Engine Was “Introduced” Underground?

**MSHA Will Conduct A Physical Inventory Of Engines At Every Underground MNM Mine. Any Engine On This Inventory Will Be Considered Compliant With §57.5067(a)(2).**



# Engines

❖ Is Non-Production Equipment Exempted?

**Only Engines In Ambulances/Fire Rigs Are Exempted.**

❖ Is “Tailpipe” Emissions Testing Required At Mine Site?

**No. This Is Engine Manufacturer’s Responsibility.**

# DPM Training

❖ Do Independent Contractors Need To Receive DPM Training?

**Yes.**

❖ If DPM Training Is Combined With Part 48 Training, Do I Need To Modify My Part 48 Training Plan?

**Yes.**

# **DPM Training**

❖ **Do Miners Who Work On The Surface At An Underground Mine Need To Receive DPM Training?**

**No.**

❖ **Must Training Be Given By MSHA-Certified Instructors?**

**No. However, If Training Is Combined Into Part 48 Training, Part 48 Requirements Apply.**

❖ **Can I Get Assistance With Training Materials?**

**Yes. MSHA Will Be Developing Training Assistance.**

# DPM Training

## ❖ Does DPM Training Need To Be Certified?

**No. Mine Operators Must Retain A Record Of Training Required For 1 year After Completion Of The Training. Note That If Training Is Combined Into Part 48 Training, Part 48 Certification Requirements Apply.**

## ❖ Where Is DPM Training Required To Be Given?

**The Standard Does Not Specify A Location Or Required Format For DPM Training. Training Can Be Given On A Written Form, At Safety Meetings, Tool Box Talks, One-On-One, Etc.**

# DPM Training

- ❖ If I Provide Initial DPM Training For A New Miner On September 1, 2001, What Is The Latest Date That Miner May Receive Annual DPM Training?

**September 30, 2002.**

- ❖ Must DPM Training Be Provided In the Language Spoken By The Miners?

**No.**